# Safety climate and its relationship with furniture companies' safety performance and workers' risk acceptance

M.A. Rodrigues, P.M. Arezes & C.P. Leão

## Abstract

This study aims to analyse the relationship between safety climate and the level of risk acceptance, as well as its relationship with workplace safety performance. The sample includes 14 companies and 403 workers. The safety climate assessment was performed by the application of a Safety Climate in Wood Industries questionnaire and safety performance was assessed with a checklist. Judgements about risk acceptance were measured through questionnaires together with four other variables: trust, risk perception, benefit perception and emotion. Safety climate was found to be correlated with workgroup safety performance, and it also plays an important role in workers' risk acceptance levels. Risk acceptance tends to be lower when safety climate scores of workgroups are high, and subsequently, their safety performance is better. These findings seem to be relevant, as they provide Occupational, Safety and Health practitioners with a better understanding of workers' risk acceptance levels and of the differences among workgroups.

Keywords

furniture companies, risk acceptance, safety climate, safety performance, workgroups

## 1. Introduction

Cultural context has been found to be an important factor in risk judgements because it determines the level of risk considered acceptable or unacceptable by a given group at a given time (Kouabenan 1998, 2009; Tingley et al. 2010). Despite this conception has been mentioned for the influence of the external social context, a similar outcome may also exist for occupational risks due to the influence of the internal cultural context. Such an analysis is important because it allows for a better understanding of how workers form their opinions on a given risk and why they adopt a certain attitude or behaviour towards risk. However, there are few studies on the influence of internal cultural context on risk acceptance.

Safety climate is an important concept in an occupational risk management and a product/sub-component (Choudhry, Fang, and Mohamed 2007) or an indicator of safety culture (Flin et al. 2000; Tharaldsen, Olsen, and Rundmo 2008; Høivik et al. 2009). Zohar emphasised safety climate in the 1980s (Zohar 1980), and it has been defined as a descriptive measure that 'can be regarded as the surface features of the safety culture discerned from the workforce's attitudes and perceptions at a given point in time' (Flin et al. 2000, 178). Therefore, safety climate can be an important indicator of several traits that influence safety (Antonsen 2009), particularly employees' attitudes, perceptions and behaviours regarding health and safety (Choudhry, Fang, and Mohamed 2007; Antonsen 2009).

By analysing the concept of safety climate and taking into account the dimensions that are frequently included in measurement instruments (see, Flin et al. 2000; Guldenmund 2000), it is possible to understand the importance of safety climate for safety management. In fact, in an occupational environment with a positive safety climate, several features are present: an organisational commitment to safety and the implementation of a safety policy where safety responsibilities and goals are clear and in accordance with the company's safety needs; safety systems that are established to promote safety and maintain low levels of risk; an environment where safety problems are quickly addressed; managers whose attitudes and behaviours demonstrate that safety is a priority; an environment that promotes safety training; an environment where the communicational channels are open, i.e., important information flows from management to the workforce and vice versa; workers who are motivated and follow the rules/procedures; and workspaces and workloads that are adequate for job efficiency. Therefore, it is plausible that companies with higher safety climate scores have higher safety performances and, hence, lower risk acceptance levels.

Despite the background provided above, few studies have analysed the role of safety climate in risk acceptance. However, a growing body of research has emerged in last years, involving different sectors of activity, which has analysed the relationship of safety climate with safety outcomes, such as risk perception (RP) (Rundmo 2000; Huang et al. 2007; Tharaldsen, Olsen, and Rundmo 2008), safety management systems (Zohar 1980; Varonen and Mattila 2000), accident rates (Varonen and Mattila 2000; Johnson 2007; Arocena, Núñez, and Villanueva 2008; Nielsen et al. 2008; Tharaldsen, Olsen, and Rundmo 2008; Vinodkumar and Bhasi 2009Hon, Chan, and Yam 2014) and safety behaviours (Rundmo 2000; Johnson 2007; Lu and Yang 2011; Fugas, Silva, and Meliá 2012; Tholén, Pousette, and Törner 2013). Consequently, individuals who work in companies with a positive safety climate tend to perceive safety management systems as more efficient. Such workers are also more likely to comply with safety procedures and rules and consequently display fewer unsafe behaviours and are less likely to be involved in an accident. It is expected that these workers also present lower risk acceptance levels, particularly when considering that the workers' level of risk acceptance can predict unsafe behaviours.

The effect of safety climate on risk acceptance can also be indirect, i.e., by influencing other factors that can have an effect on risk acceptance. Previous studies in different areas have identified other important factors that can have a direct or indirect influence on risk acceptance levels, such as RP, benefit perception, trust and emotions (see, e.g., Siegrist 1999, 2000; Siegrist, Cvetkovich, and Roth 2000; Siegrist, Gutscher, and Earle 2005; Roeser 2006; Bronfman et al. 2008; Bronfman, Vázquez, and Dorantes 2009; Ji et al. 2011; Bronfman et al. 2012; Huang et al. 2013). These factors can also be influenced by the safety climate, which highlights the importance of the internal context on risk acceptance. This influence has been noted before for some of the factors in occupational settings, but particularly for RPs, as previously noticed.

Similarly, it must be noted that internal cultural context can also influence risk acceptance on a group level because some differences in safety climate may arise among different groups, which indicates the presence of multi-subclimates (Clarke 2006; Guldenmund 2007; Zohar 2008; Brondino, Pasini, and Silva 2013; Rollenhagen, Westerlundb and Näswallc 2013) due to differences in workplace safety performance (Varonen and Mattila 2000; Cooper and Phillips 2004; Rodrigues, Arezes, and Leão in press) and management policies and to leadership/supervisors actions and co-workers' influences (Clarke 2006; Brondino, Silva, and Pasini 2012; Rodrigues, Arezes, and Leão in press). According to such assumptions, it seems that the influence of the safety climate on risk acceptance needs to be analysed at the group level.

In light of the discussion above, gaining a better understanding of the influence of internal cultural contexts on risk acceptance is highly relevant. Such information may provide significant insights to organisations seeking to anticipate and understand responses to hazards, such as safety behaviours, to improve their strategies to reduce risks and gain information about risk (Slovic 1987; Huijts, Molina, and Steg 2012). For this reason, this study aims to analyse the influence of safety climate on the level of risk acceptance by workers as well as the relationship of safety climate with workgroup safety performance. This study was carried out in the Portuguese furniture sector, as it is one of the most important economic sectors of activity in Portugal's Northern region and a place where the number of occupational accidents still remains high (Eurostat 2012).

# 2. Methodology

## 2.1. Sample

A total of 14 Portuguese furniture companies participated in the study and the data collection involved 403 participants from 33 workgroups that were identified according to the department/sector of activity, by supervision and by physical boundaries. The companies were selected according to their size and geographical location and were located in the Northern Region of Portugal, mostly in the area of Paços de Ferreira because the furniture industry is the most relevant sector in that region.

Most of the participants were males (86.6%) and their mean age was 39.49 years (SD = 10.09). Workers had been employed by their current companies for an average of 10.47 years (SD = 7.27) and had been engaged in manual labour for an average of 17.49 years (SD = 12.06).

## 2.2. Safety climate analysis

Analysis of the safety climate was performed using the Safety Climate in Wood Industries (SCWI) tool. This tool was previously developed and validated by the authors of this paper in a previous study (Rodrigues, Arezes, and Leão in press). The SCWI is a specific tool to measure the safety climate in the furniture sector that takes into account the hierarchical structure of organisations, which allows for the identification of different safety climates between groups.

The SCWI includes two main parts. The first part consists of questions related to the workers' demographics, such as age, gender, department/sector, professional activity, the duration of current employment, the number of years engaged in manual labour and previous involvement in work accidents. The second part consists of 34 items that measure the safety climate at three levels: organisational, group and individual. The organisational level was measured with 13 items related to the management's investment in safety issues, the continuous improvement of safety systems and safety communication. The group level was measured with 12 items. At this level, workers were asked about supervisory concerns related to workers' safety practices, their involvement in safety issues and their efforts in regards to rule compliance and safety protection use. Finally, at the individual level, nine items measured workers' commitment to safety. A description of the items considered for each level of analysis, can be found in Table 1.

Table 1. SCWI tool: items for measuring safety climate.

| Organisational level | Item |
|---|---|
| The management of this company. . . . | reacts quickly when a dangerous situation is detected, or there is an accident or incident occurs. |
| | insists on thorough and regular safety audits and inspections. |
| | is not interested in continually improving safety levels in each department. |
| | does not invest in modernising work machines. |
| | invests in the implementation of measures to minimise the manual handling of loads. |
| | provides all the equipment needed to do the job safely. |
| | is strict about working safely when we are working under pressure. |
| | requires each supervisor/team leader to help improve safety in his or her sector or department. |
| | invests much time and money in safety training for workers. |
| | uses all available information to improve existing safety rules. |
| | promotes the development of appropriate work procedures for the tasks performed by workers. |
| | does not consider to workers' suggestions about improving safety. |
| | provides workers with sufficient information on safety issues. |
| **Group level** | **Item** |
| My supervisor or team leader. . . | makes sure we receive all the equipment needed to do the job safely. |
| | does not check frequently to see whether we are all obeying the safety rules. |
| | discusses how to improve safety with us. |
| | rather than using explanations, compels us to act safely. |
| | worries that I fulfil with the regulations and work procedures. |
| | worries that I use all of the machines protections. |
| | lets safety rules and procedures be ignored when we are working under pressure. |
| | frequently tells us about the hazards of our work. |
| | makes that sure we follow all the safety rules, not just the most important ones. |
| | is strict about safety at the end of the shift, when we want to go home. |
| | spends time helping us learn to see problems before they arise. |
| | insists that we wear our personal protective equipment even if it is uncomfortable. |
| **Individual level** | **Item** |
| I. . . . | believe that safety is the main priority when I do my work. |
| | report dangerous situations immediately to one of my superiors whenever I see them. |
| | try to always follow the rules and work procedures when I run my work. |
| | do not use the personal protective equipment necessary for performing tasks. |
| | do not always use the machine's protections. |
| | refuse to ignore safety rules, even when the work is delayed and production must be increased. |
| | disregard safety rules at the end of the shift, when we want to go home. |
| | clarify all my questions about the risks to which I am exposed. |
| | do not bring it to my colleagues' attention when I see them violating some rule or safety procedure. |

The level of agreement with each item was assessed by using a 5-point Likert scale that ranged from '1 = strongly disagree' to '5 = strongly agree'.

## 2.3. Analysis of risk acceptance

Workers' judgements of risk acceptance were measured together with four other individual variables through a questionnaire previously developed and validated by the authors (Rodrigues, Arezes, and Leão 2014a). A 5-point Likert scale was used to measure the variables in this analysis: risk acceptance ('1 = unacceptable'; '5 = acceptable'), trust ('1 = no trust at all'; '5 = high trust'), RP ('1 = not risky at all'; '5 = very risky'), benefit perception ('1 = not beneficial at all'; '5 = very beneficial') and emotions ('1 = not worried at all'; '5 = very worried').

Questions about risk acceptance, RP and emotions were based on scenarios, which were constructed according to the sector's accident frequency distribution in relation to the number of days lost for each accident type. These scenarios took into consideration the most important types of injuries according to the results of the safety performance analysis: six scenarios related to cuts (acceptance scenario for cuts, ASC*i*, *i* = 1, …, 6), five to musculoskeletal disorders (acceptance scenario for musculoskeletal disorders, ASMSDs*i*, *i* = 1, …, 5) and one related to fatality. To analyse the perception of benefit, two groups of questions were included, i.e., benefits for the employer and benefits for the employees. Trust was measured at three different levels, i.e., trust in management's decisions on risk control, trust in the role of Occupational, Safety and Health (OSH) practitioners in risk control and trust in supervisors' abilities to enforce the rules and safety procedures. A more elaborate description of the risk scenarios utilised in this study can be found elsewhere (Rodrigues, Arezes, and Leão 2014a).

## 2.4. Companies' safety performance

A safety audit was performed for the analysis of the safety performance. This audit was supported by a checklist developed for this study based on the Portuguese legislation (e.g., Decree-Law no. 103/2008; Decree-Law no. 24/2012; Decree-Law no. 347/93; Ordinance no. 987/93) and specific guidelines for the furniture sector (e.g., Miguel et al. 2005). The checklist included 112 items related to the safety conditions of workplace, equipment and machinery as well as related to tasks (safety behaviours and procedures). The items were selected according to the major risk factors in the furniture sector and included items related to each type of machine. A 5-point Likert scale adapted from Reese (2012) was used to assess the deficiency degree of each item under analysis, in which '1 = very deficient' and '5 = excellent'. In all cases, 'not applicable' was a possible response when a risk factor was not verified as relevant to the specific situation under analysis. Towards the end of the safety condition analysis, all results were discussed with the companies' managers and supervisors.

## 2.5. Procedures

During the first stage, a safety audit was performed in each company. Subsequently, questionnaires were administered to all workers, which were completed during working hours or at the end of the work shift. Participants were notified that the questionnaire was voluntary and anonymous and that all collected data were to be used by the researchers for scientific purposes only. Workers were also informed that if they had experienced any difficulties in answering any of the questions, they could request assistance from the researchers or company managers.

## 2.6. Data analysis

The safety performance was estimated in percentages for each group while taking into account the total number of filled out items on the checklist and their corresponding score (according to the 5-point scale).

Concerning the safety climate, scores were determined by adding up the level of respondents' agreement with each item included in the scale. Bivariate correlation analysis was performed using the statistical software package IBM SPSS® version 20 to analyse the correlation between safety climate and other variables in the analysis.

## 3. Results

### 3.1. Safety performance and safety climate

The average of safety climate scores for each workgroup and scale as well as the percentage of workgroup safety performance was calculated. The results of which are presented in Table 2.

Table 2. Safety climate average scores by group and scale and percentage of safety performance.

| Company | Group | Organisational scale ($x \pm$ sd) | Group scale ($x \pm$ sd) | Individual scale ($x \pm$ sd) | Total average score ($x \pm$ sd) | Total safety performance (%) |
|---|---|---|---|---|---|---|
| A | 1 | 35.0 ± 2.5 | 28.4 ± 3.0 | 28.4 ± 1.0 | 91.8 ± 4.96 | 54.70 |
| B | 2 | 37.1 ± 6.9 | 35.4 ± 4.9 | 34.4 ± 4.1 | 106.9 ± 8.0 | 59.60 |
| | 3 | 32.9 ± 3.3 | 35.7± 4.9 | 31.6 ± 2.2 | 100.1 ± 7.8 | 60.90 |
| | 4 | 46.2 ± 4.7 | 41.8 ± 3.8 | 33.8 ± 3.3 | 121.8 ± 8.5 | 62.90 |
| | 5 | 41.3 ± 1.4 | 40.3 ± 2.1 | 31.0 ± 1.6 | 112.7 ± 2.8 | 61.10 |
| | 6 | 49.0 ± 2.5 | 46.7 ± 5.5 | 33.0 ± 7.5 | 128.8 ± 4.8 | 71.10 |
| C | 7 | 37.8 ± 6.6 | 45.6 ± 3.2 | 36.2 ± 4.4 | 119.6 ± 8.1 | 62.30 |
| | 8 | 46.4 ± 7.1 | 41.5 ± 4.3 | 33.2 ± 3.0 | 121.1 ± 8.2 | 63.60 |
| | 9 | 44.4 ± 3.8 | 41.6 ± 3.0 | 33.4 ± 4.3 | 119.4 ± 6.5 | 65.20 |
| | 10 | 43.7 ± 3.8 | 40.1 ± 3.0 | 40.5 ± 4.1 | 124.2 ± 4.8 | 69.50 |
| D | 11 | 45.6 ± 4.8 | 41.4 ± 4.1 | 32.8 ± 4.4 | 119.8 ± 8.0 | 67.00 |
| | 12 | 47.4 ± 5.2 | 43.3 ± 2.7 | 31.45 ± 3.2 | 122.1 ± 9.6 | 69.00 |
| E | 13 | 50.8 ± 1.6 | 41.0 ± 2.2 | 34.8 ± 1.0 | 126.6 ± 2.9 | 71.90 |
| F | 14 | 44.0 ± 3.1 | 38.1 ± 2.5 | 31.3 ± 3.0 | 113.4 ± 8.8 | 60.70 |
| G | 15 | 35.5 ± 1.9 | 31.2 ± 3.6 | 26.2 ± 2.9 | 93.0 ± 6.5 | 57.20 |
| | 16 | 33.5 ± 1.5 | 40.8 ± 5.0 | 30.5 ± 2.2 | 104.7 ± 7.7 | 59.70 |
| H | 17 | 55.4 ± 4.0 | 44.7 ± 2.7 | 36.1 ± 2.9 | 136.3 ± 7.7 | 73.60 |
| | 18 | 53.9 ± 2.1 | 45.8 ± 2.0 | 33.9 ± 3.4 | 133.6 ± 5.0 | 61.20 |
| | 19 | 54.0 ± 4.8 | 45.3 ± 3.6 | 36.3 ± 3.9 | 135.7 ± 8.0 | 75.90 |
| | 20 | 56.1 ± 4.6 | 48.7 ± 4.5 | 37.4 ± 5.1 | 142.3 ± 9.2 | 78.50 |
| I | 21 | 24.7 ± 1.6 | 27.6 ± 2.5 | 18.3 ± 1.1 | 70.7 ± 1.9 | 55.10 |
| J | 22 | 45.4 ± 3.6 | 37.6 ± 3.8 | 31.6 ± 2.9 | 114.6 ± 6.2 | 67.20 |
| | 23 | 48.6 ± 2.7 | 40.8 ± 3.3 | 35.0 ± 1.5 | 124.4 ± 3.0 | 70.60 |
| | 24 | 45.9 ± 1.4 | 43.0 ± 1.4 | 33.4 ± 0.9 | 122.3 ± 0.9 | 63.40 |
| | 25 | 48.8 ± 1.8 | 47.2 ± 2.2 | 36.4 ± 2.6 | 132.4 ± 4.5 | 73.20 |
| K | 26 | 51.1 ± 4.5 | 42.9 ± 4.6 | 35.1±2.0 | 129.1 ± 7.1 | 72.40 |
| | 27 | 42.8 ± 3.8 | 38.5 ± 1.5 | 30.2 ± 1.1 | 111.5 ± 5.0 | 68.60 |
| M | 28 | 49.8 ± 3.8 | 41.2 ± 1.7 | 32.5 ± 3.2 | 123.7 ± 6.1 | 63.20 |
| | 29 | 56.0 ± 3.1 | 43.8 ± 3.8 | 38.5 ± 1.8 | 137.7 ± 6.4 | 64.20 |
| | 30 | 51.0 ± 3.6 | 41.2 ± 4.1 | 31.4 ± 2.8 | 123.6 ± 7.7 | 60.60 |
| | 31 | 53.5 ± 3.5 | 46.9 ± 4.7 | 36.7 ± 3.1 | 137.1 ± 8.4 | 73.00 |
| N | 32 | 40.4 ± 1.8 | 39.4 ± 1.7 | 27.7 ± 1.74 | 107.5 ± 5.3 | 74.90 |
| L | 33 | 51.2 ± 1.8 | 39.2 ± 1.8 | 30.25 ± 1.0 | 120.7 ± 1.0 | 61.20 |

For safety performance, in general, higher values were found for companies E, H and N and lower values for companies A, G and I. Within companies, the level of safety performance was different among workgroups. Specifically, it was lower in groups related to the cutting department and higher in groups related to storage and assemblage departments. Results in regard to safety climate were similar to those in safety performance: groups linked to the cutting department represented the lowest safety climate level in the company (e.g., groups 7, 11, 15, 18, 22, 27 and 30) and groups linked to the storage and assemblage departments represented the highest safety climate level (e.g., groups 8, 10, 12, 16, 20, 23, 25, 26 and 29). Group 20 from company H represents the highest safety climate level, whereas group 21 from company I represents the lowest level of safety climate.

Because the results indicated a relationship between the scores on safety climate and the percentage of safety performance, the next step was to examine the correlations between these variables. The analysis of the relationship between safety climate level and the companies' safety performance was performed at the group level using the aggregated mean scores of the safety climate for each group in the analysis. This choice was made because safety performance was measured at the group level. Statistically significant differences were found across workgroups (total safety climate score (KW(32) = 209.16, $p < 0.001$); organisational level (KW(32) = 237.32, $p < 0.001$); group level (KW(32) = 169.83, $p < 0.001$); and individual level (KW(32) = 154.01, $p < 0.001$)). The analysis was performed separately for each safety climate scale and for the total safety climate score.

Table 3 shows the correlations and their corresponding levels of significance. A strong linear positive relation was found for all the scales in this analysis, which indicates that higher safety climate scores correspond with higher safety behaviours and with a workplace with better safety conditions.

Table 3. Linear relation between safety performance and safety climate, by safety climate scale.

| | $r$ | $r^2$ | Adj. $r^2$ | Df | $F$ | Sig. |
|---|---|---|---|---|---|---|
| Organisational level | 0.639 | 0.408 | 0.389 | 1 | 21.359 | 0.000 |
| Group level | 0.686 | 0.471 | 0.454 | 1 | 27.564 | 0.000 |
| Individual level | 0.564 | 0.391 | 0.297 | 1 | 14.496 | 0.001 |
| Total safety climate | 0.697 | 0.486 | 0.469 | 1 | 29.292 | 0.000 |

## 3.2. Influence of safety climate on risk acceptance

The relationship between safety climate and risk acceptance was analysed in this study. In this regard, correlations between each scale of safety climate and each scenario for risk acceptance were calculated at the individual level (Table 4). The correlations were insignificant for organisational and group scales, with the exception of scenarios ASC2 ($r = -0.249$, $p < 0.001$), ASC3 ($r = -0.118$, $p < 0.05$) and ASMSDs4 ($r = 0.126$, $p < 0.05$) on the organisational scale as well as of ASC6 ($r = 0.099$, $p < 0.05$), ASMSDs4 ($r = 0.115$, $p < 0.001$) and ASD ($r = -0.120$, $p < 0.05$) on the group scale. On the individual scale, however, the correlations were significant and negative, with the exception of scenarios ASMSDs2 ($r = -0.084$, $p > 0.05$), ASMSDs3 ($r = -0.077$, $p > 0.05$) and ASMSDs4 ($r = -0.020$, $p > 0.05$).

Table 4. Pearson correlations between risk acceptance and each scale of safety climate.

| | Organisational safety climate | Group safety climate | Individual safety climate |
|---|---|---|---|
| ASC1 | −0.044 | −0.091 | −0.159** |
| ASC2 | −0.249** | −0.212 | −0.280** |
| ASC3 | −0.118* | −0.121 | −0.241** |
| ASC4 | −0.027 | −0.060 | −0.206** |
| ASC5 | 0.067 | 0.070 | −0.150** |
| ASC6 | 0.037 | 0.099* | −0.157** |
| ASMSDs1 | 0.046 | −0.058 | −0.144** |
| ASMSDs2 | 0.085 | 0.027 | −0.084 |
| ASMSDs3 | 0.059 | 0.093 | −0.077 |
| ASMSDs4 | 0.126* | 0.115** | −0.020 |
| ASMSDs5 | −0.052 | −0.012 | −0.113** |
| ASD | −0.031 | −0.120* | −0.151** |

ASC = acceptance scenario for cuts; ASMDS = acceptance scenario for MSDs; ADS = acceptance scenario for death.
*$p < 0.05$; **$p < 0.001$.

A similar analysis was conducted for RP. As shown in Table 5, RP was found to be positively correlated with individual safety climate scale for most of the scenarios with the exception of three scenarios related with MSDs: RPSMSDs3 (risk perception scenario for musculoskeletal disorders; $r = 0.072$, $p > 0.05$), RPSMSDs4 ($r = 0.042$, $p > 0.05$), RPSMSDs5 ($r = 0.009$, $p > 0.05$), and with the scenario for death RPSD ($r = 0.034$, $p > 0.05$). Six scenarios on the organisational safety climate scale were significantly correlated with RPs. However, only scenarios RPSC1 ($r = 0.119$, $p < 0.05$), RPSC2 ($r = 0.239$, $p < 0.001$) and RPSC3 ($r = 0.103$, $p < 0.05$) were positively correlated. These scenarios were also significantly correlated with RP on the group safety climate scale, namely with RPSC1 ($r = 0.125$, $p < 0.05$), RPSC2 ($r = 0.241$, $p < 0.001$) and RPSC3 ($r = 0.110$, $p < 0.05$).

Table 5. Pearson correlations between risk perception and each scale of safety climate.

| | Organisational safety climate | Group safety climate | Individual safety climate |
|---|---|---|---|
| RPSC1 | 0.119* | 0.125* | 0.251** |
| RPSC2 | 0.239** | 0.241** | 0.318** |
| RPSC3 | 0.103* | 0.110* | 0.224** |
| RPSC4 | −0.040 | 0.049 | 0.140** |
| RPSC5 | −0.037 | 0.004 | 0.177** |
| RPSC6 | −0.064 | −0.062 | 0.103* |
| RPSMSDs1 | −0.047 | 0.046 | 0.174** |
| RPSMSDs2 | −0.019 | 0.052 | 0.145** |
| RPSMSDs3 | −0.065 | −0.020 | 0.072 |
| RPSMSDs4 | −0.150** | −0.068 | 0.042 |
| RPSMSDs5 | −0.123* | −0.082 | 0.009 |
| RPSD | −0.131** | −0.056 | 0.034 |

RPSC = risk perception scenario for cuts; RPSMSD = risk perception scenario for MSDs; RPSD = risk perception scenario for death.
*$p < 0.05$; **$p < 0.001$.

Correlations between safety climate scales and benefit perceptions were also analysed and the results are presented in Table 6. Benefits for employers (BE) and benefits for workers (BW), took the following three situations into consideration: 'operating saws without protection' (1), 'performing repetitive tasks for long periods of time' (2) and 'performing manual tasks in material handling' (3). The results showed that only BE1 was negatively correlated with safety climate on the organisational scale ($r = -0.126$, $p < 0.05$) and on the individual scale ($r = -0.112$, $p < 0.05$).

Table 6. Pearson correlations between benefit perception and safety climate.

| | Organisational safety climate | Group safety climate | Individual safety climate |
|---|---|---|---|
| BE1 | −0.126* | −0.091 | −0.112* |
| BE2 | 0.061 | 0.026 | −0.037 |
| BE3 | 0.026 | 0.048 | −0.021 |
| BW1 | −0.059 | −0.011 | −0.008 |
| BW2 | 0.034 | 0.066 | 0.058 |
| BW3 | 0.019 | 0.063 | 0.050 |

BE = benefits for employers; BW = benefits for workers.
*$p < 0.05$.

The relationship between emotions and risk acceptance presented an interesting finding (Table 7). While the correlation between each emotive scenario and the individual scale of safety climate was significant and positive for most of the cut wound scenarios ($p < 0.001$), with the exception of scenario ESC6 ($r = 0.079$; $p > 0.05$), no relationship was found between these variables for MSDs and death scenarios. This was unexpected because emotions were found to be strongly correlated with RP (correlations between $r = 0.468$ and $r = 0.680$; $p < 0.001$). For that reason, it was expected that emotive scenarios were going to be more frequently correlated with safety climate on the individual scale.

Table 7. Pearson correlations between emotions and each scale of safety climate.

| | Organisational safety climate | Group safety climate | Individual safety climate |
|---|---|---|---|
| ESC1 | 0.031 | 0.062 | 0.133** |
| ESC2 | 0.136** | 0.110* | 0.143** |
| ESC3 | 0.099* | 0.093 | 0.179** |
| ESC4 | 0.051 | 0.066 | 0.155** |
| ESC5 | −0.030 | −0.002 | 0.134** |
| ESC6 | −0.080 | −0.068 | 0.079 |
| ESMSDs1 | −0.019 | 0.018 | 0.048 |
| ESMSDs2 | −0.094 | −0.026 | 0.036 |
| ESMSDs3 | −0.032 | 0.005 | 0.096 |
| ESMSDs4 | −0.167** | −0.093 | 0.015 |
| ESMSDs5 | −0.127* | −0.097 | 0.057 |
| ESD | −0.109* | 0.014 | 0.014 |

ESC = emotions scenario for cuts; ESMDS = emotions scenario for MSDs; EDS = emotions scenario for death.
*$p < 0.05$; **$p < 0.001$.

Table 8. Pearson correlations between trust and safety climate.

| | Organisational safety climate | Group safety climate | Individual safety climate |
|---|---|---|---|
| TMang | 0.309** | 0.230** | 0.033 |
| TOSH | 0.258** | 0.278** | 0.007 |
| TSuper | 0.278** | 0.259** | −0.010 |

TMang = trust on management' decisions; TOSH = trust on OSH practitioners' actuation; TSuper = trust on supervisor' action.
*$p < 0.05$; **$p < 0.001$.

To better understand these results, an analysis of the differences between two cut wound scenarios and two MSDs scenarios with a same frequency and accident severity degree was performed. Significant differences were found between the two types of injuries ($W = -3.795$, $p < 0.001$; $W = -1.990$, $p < 0.05$), where higher levels of fear were reported for cut wound scenarios.

Regarding the other scales, negative correlations were found for some scenarios on the organisational scale of safety climate, ESMSDs4 ($r = -0.167$, $p < 0.01$), ESMSDs5 ($r = -0.127$, $p < 0.05$) and ESD ($r = -0.109$, $p < 0.05$), whereas positive correlations were found only for scenarios ESC2 ($r = 0.136$, $p < 0.01$) and ESC3 ($r = 0.099$, $p < 0.05$). Concerning the group scale, only ESC2 ($r = 0.110$, $p < 0.05$) was found significantly correlated.

Additionally, the relationship between trust and each scale of safety climate was analysed. The results showed that trust in management's decisions (TMang), OSH practitioners' actuation (TOSH) and in supervisor's action (TSuper) were positive and statistically significantly correlated with the organisational and group safety climate scales ($p < 0.001$). Insignificant correlations were found for the individual safety climate scale ($p > 0.05$) (Table 8).

4. Discussion

This study sought to determine if safety climate is related to safety performance in companies and how safety climate influences occupational risk acceptance. To support that analysis, a multilevel approach was used to better understand the relationships between these variables at the different organisational levels.

As expected, the study showed that safety climate differs across workgroups and is correlated with safety performance levels. This is in accordance with previous studies, which have identified safety climate differences due to the influence of the workgroups/companies safety performance (Varonen and Mattila 2000; Cooper and Phillips 2004). That correlation was found for each scale in the SCWI tool, i.e., the organisational, group and individual scales, which highlights the importance of each organisational level in measurements of the workgroup safety climate. This reflects the importance that policies and procedures, defined by the companies' management and implemented by supervisors during their interaction with workers, have in the improvement of workplace safety (Guldenmund 2007). Workers may see a relationship between poor working conditions in their workplace, and their managers' activity and/or their supervisors' leadership capacities as well as his/her concerns and involvement with safety issues (Guldenmund 2007; Martínez-Córcoles et al. 2013). However, it is important to note that the norms and safety attitudes of co-workers can also have an influence on workers' commitment to safety (Fugas, Silva, and Meliá 2012; Brondino, Pasini, and Silva 2013). Furthermore, attitudes and behaviours of workers towards safety can also be influenced by both rational and perceptual processes at the individual level (Guldenmund 2007).

Differences in safety climate among workgroups have been previously identified (e.g., Tharaldsen, Mearns, and Knudsen 2010; Brondino, Pasini, and Silva 2013; Rollenhagen, Westerlundb and Näswallc 2013). The differences found among workgroups in relation to safety climate levels in this study were interesting because they indicate that workers' perception of managerial efforts and supervisory actions in regards to safety differs across workgroups even when some groups had the supervisor. These results can be linked to the different contexts of workgroups, e.g., safety performance levels, process demands and work pressure.

In general, the obtained results indicated that workgroups in the cutting department are the most problematic in relation to safety climate and safety performance. In fact, in the majority of furniture companies this department is the most critical in regards to workers' safety. According to Miguel et al. (2005) saws, drills and milling–cutting machines, without any protection or with their protection compromised by workers, were the most common risk factors in this department. This observation was confirmed by this study during the safety audit. In addition, situations involving high noise exposure, manual material handling as well as materials and cables stored on passageways, were observed in the cutting departments of most of the companies in this study. Furthermore, there is high pressure on the cutting department in relation to production objectives because other departments are dependent on the cutting department's productivity. Thus, workers from this department may be subjected to greater pressure from supervisors, this may explain the tendency to value production over safety (Reese 2012), which may lead workers to ignore some of the safety rules and procedures. This problem is exacerbated by the fact that there are more risk factors in this sector and that the number of rules and procedures is higher, which makes it more difficult for managers and supervisors to ensure that workers are in compliance with all the procedures and rules.

The obtained results also suggest the absence of a relationship between safety climate scores and company size. According to a study of the Portuguese Management School of Porto (EGP, n.d.), most of the furniture companies in Portugal are small size companies. Furthermore, these small companies are expected to have less resources to improve safety, have a reduced professionalisation in terms of management, marketing and trade policies, and most of their workforce consists of unqualified and undifferentiated workers. Bearing this in mind, this study included companies of differing sizes and an effort was made to include several smaller companies because they are more representative of this sector. Despite the previous assumption that smaller companies may have poorer safety performance, the results of this study showed that the smallest companies can have both high and low safety climate scores.

The overall picture of this study also showed that safety climate is significantly associated with risk acceptance and that other variables can influence risk acceptance. However, the influence of each hierarchical level is different across each of the variables.

The individual scale of SCWI was found to have both a direct and indirect influence on risk acceptance by influencing RP, benefit perception and emotions. Regarding risk acceptance, all scenarios except for the three MSDs scenarios were found to be negatively correlated with the individual scale. A significant positive relation of this scale with workers' judgements about RP was also found for the most of the scenarios, except for four scenarios, three MSDs scenarios and the death scenario.

Regarding benefits, the results were also interesting. Only benefits for the employer related to 'operating saws without protection' were found to be negatively correlated with the individual scale in SCWI tool. The same occurred with emotions, where only cut wound scenarios were found to be positively correlated with this scale. These results suggested that the influence of safety climate on risk acceptance can be dependent on the mode of injury, which in this specific study was higher for the cut wound scenarios than for MSDs scenarios. In this case, fear related to cut wound scenarios played an important role. Workers believed the consequences of cut wound scenarios to be more negative because in the furniture companies these are frequently related to permanent injuries (amputations).

Despite the scarcity of studies on the influence of safety climate on risk acceptance levels, several studies have already identified the relationship between safety climate and safety outcomes, particularly in regards to safety behaviours and compliance with safety rules and procedures (see, e.g., Rundmo 2000; Johnson 2007; Lu and Yang 2011; Fugas, Silva, and Meliá 2012 Tholén, Pousette, and Törner 2013) and to RP (Rundmo 2000; Huang et al. 2007; Tharaldsen, Olsen, and Rundmo 2008), which indicates also a relationship with risk acceptance. In fact, when faced with a risk situation, workers with lower risk acceptance are willing to work safely, to comply with company procedures and policies, to display safer behaviours and to participate more in the safety management process (Rundmo 2000; Huang et al. 2007). Concerning RP, however, the results contrast with those obtained by Tharaldsen, Olsen, and Rundmo (2008), where the associations between safety climate scales and RP generally showed a significant but negative relationship. Additionally, Huang et al. (2007) found that individuals who work for a company with a more positive safety climate perceive a lower risk of injury. These divergences were related to differences in the applied methodology because Huang et al. (2007) assessed workers' perception of the risk of getting injured on their job. Tharaldsen, Olsen, and Rundmo (2008) also analysed the RP of the occurrence of specific risk scenarios on their own platform. These authors found that workers in companies with higher safety climate scores perceive less risk of being injured or identify a specific risk situation as less probable to occur in their own company. In general, these are workers in companies with a lower frequency of injuries. Moreover, these companies have more efficient safety management systems and workers comply with safety procedures and rules (Varonen and Mattila 2000; Johnson 2007; Arocena, Núñez, and Villanueva 2008; Nielsen et al. 2008; Tharaldsen, Olsen, and Rundmo 2008; Vinodkumar and Bhasi 2009; Lu and Yang 2011; Fugas, Silva, and Meliá 2012; Tholén, Pousette, and Törner 2013; Hon, Chan, and Yam 2014). In this study, the applied approach was different because workers were asked to make a judgement on their level of RP in specific scenarios with a specific frequency and severity and not asked to estimate the likelihood of these situations occurring in their company. As expected, the results showed that an individual who works in workgroups with high safety climate scores judges the presented scenarios as being a higher risk.

The relationship between organisational and group scales of SCWI with regards to risk acceptance, RP and emotions was found to be limited. Despite the importance of supervisory commitment to and involvement with safety work as well as managerial action in rational judgements about risk identified in previous studies (Rundmo 2000), this study found only a few scenarios that were correlated with these scales and in some cases the correlation was not the expected one. These results suggest that the actions and concerns of managers and supervisors regarding safety did not have a direct influence on risk acceptance and that other features of workgroups can play a more important role. Co-workers norms can explain these results because such norms have been related to safety climate differences among workgroups (Glendon, Clarke, and Mckenna 2006; Brondino, Silva, and Pasini 2012; Fugas, Silva, and Meliá 2012). In fact, co-workers provide information to other workers and thus can influence safety behaviour and perceptions (Brondino, Silva, and Pasini 2012). Consequently, co-workers may have a greater importance than supervisors and managers in the risk acceptance level found in this study.

Despite the previous results, organisational and group scales of SCWI were found to be strongly correlated with trust and, consequently, have an indirect influence on risk acceptance (Siegrist, Cvetkovich, and Roth 2000; Siegrist, Gutscher, and Earle 2005; Bronfman et al. 2008, 2012; Bronfman, Vázquez, and Dorantes 2009; Huang et al., 2013; Rodrigues, Arezes, and Leão 2014b). Trust seems to be an important factor in the risk management process as it can open communication channels and improve the workgroup safety climate (Jeffcott et al. 2006). If trust in the managers, supervisors and OSH practitioners' exists, a higher commitment to safety can be expected. Furthermore, workers are motivated to follow the rules and procedures and to report any hazard or other nonconformity that they can find to their supervisor or manager. As a consequence, higher safety climate levels are expected in such situations (Luria 2010). However, it is important to note that this process can work in both directions, as safety climate can also have effects on trust (Jeffcott et al. 2006).

The organisational scale was also found to influence benefit perception of the employer but only for one specific scenario: 'operating saws without protection. This risky behaviour is, actually, a common practice in this sector in order to increase production results (Rodrigues, Arezes, and Leão in press). However, when the level of safety climate increases, no benefit is observed by workers related to this dangerous scenario. Consequently, workers who deem their managers to be concerned with safety issues and with the continuous improvement of safety systems and that are willing to listen to workers' concerns as well as their recommendations, express more fear of dangerous situations.

## 5. Conclusion

This study was based on the assumption that safety climate may influence safety performance and risk acceptance. In using a multilevel approach, the consequences of potential safety climate differences between workgroups and how these differences might influence these variables were analysed.

In general, the obtained results identified safety climate as a good measure to predict and monitor the safety performance of the workgroups, showing that the higher safety climate scores are, the higher safety behaviours and safety conditions in workplaces will be. Moreover, the results also showed that SCWI is a good tool to be used in furniture companies for the analysis of safety performance as it allows to identify differences among workgroups.

In this study, an important relationship between safety climate and risk acceptance was also identified. However, the pattern of the identified relationships was complex. Only the individual scale of SCWI that was related to workers commitment to safety is correlated with risk acceptance, RP and emotion scenarios. Conversely, issues related to managerial and supervisory concerns and actions measured at the organisational and the group level were correlated with trust. Perceived benefits were correlated with individual and organisational scales. These results allow for a better understanding of the importance of each hierarchical level of risk acceptance because they can have both a direct and indirect influence.

Another important issue was the observed differences among workgroups. The results suggested that the level of risk acceptance may differ across different work contexts. In general, in groups with higher levels of safety climate, the safety conditions are better and workers show lower levels of risk acceptance. These differences also occurred with the other analysed variables. The trust in supervisors, OSH practitioners and managers is higher in groups with higher safety climate scores. In those groups also the RP and the reported level of threat are higher and the perception of benefits is lower. Conversely, higher risk of acceptance levels is expected from groups with lower safety climate levels. This can lead to an increase of unsafe behaviours and to the deterioration of safety conditions in workplaces. In this context, the results show that culture (measured by safety climate) creates the context for risk acceptance, as has been previously determined by Kouabenan (2009). Additionally, in cut wound scenarios more relationships were established for emotions and the perception of benefits, which allows one to assume that consequences as they are perceived by workers in relation to specific scenarios can mediate the relationship between safety climate and risk acceptance. However, additional studies are necessary, especially if they focus on other types of injury. It would also be interesting to examine these relationships within other industrial sectors.

The current findings are important for OSH practitioners in the sense that it will allow them to understand how workers create their opinion about a given risk and why they adopt a certain attitude towards it, as well as why different workgroups react differently to the same risky situation. The influence of the safety climate on risk acceptance in all the relationships identified among the different variables can help to establish a strategy to decrease workers' tolerance for risk.

# Notes

ASC = acceptance scenario for cuts; ASMDS = acceptance scenario for MSDs; ADS = acceptance scenario for death.

*$p$ < 0.05; **$p$ < 0.001.

RPSC = risk perception scenario for cuts; RPSMSD = risk perception scenario for MSDs; RPSD = risk perception scenario for death.

*$p < 0.05$; **$p < 0.001$.

BE = benefits for employers; BW = benefits for workers.

*$p < 0.05$.

ESC = emotions scenario for cuts; ESMDS = emotions scenario for MSDs; EDS = emotions scenario for death.

*$p < 0.05$; **$p < 0.001$.

TMang = trust on management' decisions; TOSH = trust on OSH practitioners' actuation; TSuper = trust on supervisor' action.

*$p < 0.05$; **$p < 0.001$.

References

1. Antonsen, S. 2009. “The Relationship Between Culture and Safety on Offshore Supply Vessels.” Safety Science 47 (8): 1118–1128.

2. Arocena, P., I. Núñez, and M. Villanueva. 2008. “The Impact of Prevention Measures and Organizational Factors on Occupational Injuries.” Safety Science 46 (9): 1369–1384.

3. Brondino, M., M. Pasini, and S.C.A. Silva. 2013. “Development and Validation of an Integrated Organizational Safety Climate Questionnaire with Multilevel Confirmatory Factor Analysis.” Quality & Quantity 47 (4): 2191–2223.

4. Brondino, M., S.A. Silva, and M. Pasini. 2012. “Multilevel Approach to Organizational and Group Safety Climate and Safety Performance: Co-workers as the Missing Link.” Safety Science 50 (9): 1847–1856.

5. Bronfman, N.C., R.B. Jiménez, P.C. Arévalo, and L.A. Cifuentes. 2012. “Understanding Social Acceptance of Electricity Generation Sources.” Energy Policy 46: 246–252.

6. Bronfman, N.C., E.L. Vázquez, and G. Dorantes. 2009. “An Empirical Study for the Direct and Indirect Links Between Trust in Regulatory Institutions and Acceptability of Hazards.” Safety Science 47 (5): 686–692.

7. Bronfman, N.C., E.L. Vázquez, V.V. Gutiérrez, and L.A. Cifuentes. 2008. “Trust, Acceptance and Knowledge of Technological and Environmental Hazards in Chile.” Journal of Risk Research 11 (6): 755–773.

8. Choudhry, R.M., D. Fang, and S. Mohamed. 2007. “The Nature of Safety Culture: A Survey of the State-of-the-Art.” Safety Science 45 (10): 993–1012.

9. Clarke, S. 2006. “Contrasting Perceptual, Attitudinal and Dispositional Approaches to Accident Involvement in the Workplace.” Safety Science 44 (6): 537–550.

10. Cooper, M.D., and R.A. Phillips. 2004. “Exploratory Analysis of the Safety Climate and Safety Behavior Relationship.” Journal of Safety Research 35 (5): 497–512.

11. Decreto Lei nº 103/2008 de 24 de junho. [Decree Law nº 103/2008 of 24 June] Diário da República, 1a Série – nº 120. Lisboa, Portugal: Ministério da Economia e da Inovação.

12. Decreto Lei nº 24/2012 de 6 de fevereiro. [Decree Law nº 24/2012 of 6 February] Diário da República, 1a Série – nº 26. Lisboa, Portugal: Ministério da Economia e do Emprego.

13. Decreto Lei nº 347/1993 de 1 de outubro. [Decree Law nº 347/1993 of 1 October] Diário da República, I Série A– nº 231. Lisboa, Portugal: Ministério da Economia e do Emprego.

14. Escola de Gestão do Porto (EGP). (n.d.) Estudo Estratégico das Indústrias de Madeira e Mobiliário. Porto: Associação das Indústrias de Madeira e Mobiliário de Portugal (AIMMP). http://norteemrede.inescporto.pt/rede-informacao-regional/publicacoes/estudo-estrategico-da-industria-de-mobiliario

15. Eurostat [Internet]. 2012. Annual detailed enterprise statistics for industry (NACE Rev.2 B-E). Accessed October 10. http://appsso.eurostat.ec.europa.eu/nui/setupModifyTableLayout.do

16. Flin, R., K. Mearns, P. O'Connor, and R. Bryden. 2000. "Measuring Safety Climate: Identifying the Common Features." Safety Science 34 (1–3): 177–192.

17. Fugas, C.S., S.A. Silva, and J.L. Meliá. 2012. "Another Look at Safety Climate and Safety Behavior: Deepening the Cognitive and Social Mediator Mechanisms." Accident Analysis Prevention 45: 468–477.

18. Glendon, A.I., S.G. Clarke, and E.F. Mckenna. 2006. Human Safety and Risk Management. 2nd ed. USA: Taylor & Francis Group.

19. Guldenmund, F.W. 2000. "The Nature of Safety Culture: A Review of Theory and Research." Safety Science 34 (1–3): 215–257.

20. Guldenmund, F.W. 2007. "The Use of Questionnaires in Safety Culture Research – an Evaluation." Safety Science 45 (6): 723–743.

21. Høivik, D., J.E. Tharaldsen, V. Baste, and B.E. Moen. 2009. "What is Most Important for Safety Climate: The Company Belonging or the Local Working Environment? – a Study from the Norwegian Offshore Industry." Safety Science 47 (10): 1324–1331.

22. Hon, C.K.H., A.P.C. Chan, and M.C.H. Yam. 2014. "Relationship Between Safety Climate and Safety Performance of Building Repair, Maintenance, Minor Alteration and Addition (RMAA) Works." Safety Science 65: 10–19.

23. Huang, L., J. Ban, K. Sun, Y. Han, Z. Yuan, and J. Bi. 2013. "The Influence of Public Perception on Risk Acceptance of the Chemical Industry and the Assistance for Risk Communication." Safety Science 51 (1): 232–240.

24. Huang, L., B. Duan, J. Bi, Z. Yuan, and J. Ban. 2010. "Analysis of Determining Factors of the Public's Risk Acceptance Level in China." Human and Ecological Risk Assessment: An International Journal 16: 365–379.

25. Huang, Y.-H., J.-C. Chen, S. DeArmond, K. Cigularov, and P.Y. Chen. 2007. "Roles of Safety Climate and Shift Work on Perceived Injury Risk: A Multi-level Analysis." Accident Analysis and Prevention 39 (6): 1088–1096.

26. Huijts, N.M.A., E.J.E. Molina, and L. Steg. 2012. “Psychological Factors Influencing Sustainable Energy Technology Acceptance: A Review-Based Comprehensive Framework.” Renewable and Sustainable Energy Reviews 16 (1): 525–531.

27. Jeffcott, S., N. Pidgeon, A. Weyman, and J. Walls. 2006. “Risk, Trust, and Safety Culture in U.K. Train Operating Companies.” Risk Analysis 26 (5): 1105–1121.

28. Ji, M., X. You, J. Lan, and S. Yang. 2011. “The Impact of Risk Tolerance, Risk Perception and Hazardous Attitude on Safety Operation Among Airline Pilots in China.” Safety Science 49 (10): 1412–1140.

29. Johnson, S.E. 2007. “The Predictive Validity of Safety Climate.” Journal of Safety Research 38 (5): 511–521.

30. Kouabenan, D.R. 1998. “Beliefs and the Perception of Risks and Accidents.” Risk Analysis 18 (3): 243–252.

31. Kouabenan, D.R. 2009. “Role of Beliefs in Accident and Risk Analysis and Prevention.” Safety Science 47 (6): 767–776.

32. Lu, C.-S., and C.-S. Yang. 2011. “Safety Climate and Safety Behavior in the Passenger Ferry Context.” Accident Analysis Prevention 43 (1), 329–341.

33. Luria, G. 2010. “The Social Aspects of Safety Management: Trust and Safety Climate.” Accident Analysis and Prevention 42 (4): 1288–1295.

34. Martínez-Córcoles, M., F.J. Gracia, I. Tomás, J.M. Peiró, and M. Schöbel. 2013. “Empowering Team Leadership and Safety Performance in Nuclear Power Plants: A Multilevel Approach.” Safety Science 51 (1): 293–301.

35. Miguel, A.S., G. Perestrelo, J.M. Machado, M. Freitas, F. Campelo, F.J. Lopes, J.M. Silva, and C. Braga. 2005. Manual de segurança higiene e saúde no trabalho para as industrias da fileira da madeira. Porto: Associação das Indústrias de Madeira e Mobiliário de Portugal (AIMMP).

36. Nielsen, K.J., K. Rasmussen, D. Glasscock, and S. Spangenberg. 2008. “Changes in Safety Climate and Accidents at Two Identical Manufacturing Plants.” Safety Science 46 (3): 440–449.

37. Portaria nº 987/93 de 6 de outubro. [Ordinance nº 987/93 of 6 de October] Diário da República, I Série B– nº 234. Lisboa, Portugal: Ministério do Emprego e da Segurança Social.

38. Reese, C.D. 2012. Accident/Incident Prevention Techniques. 2nd ed. USA: Taylor & Francis Group.

39. Rodrigues, M.A., P. Arezes, and C.P. Leão. (in press). “Multilevel Model of Safety Climate for Furniture Industries.” Work: A Journal of Prevention, Assessment and Rehabilitation.

40. Rodrigues, M.A., P. Arezes, and C.P. Leão. 2014a. “Development of an Instrument to Analyze the Occupational Risk Acceptance.” In Safety, Reliability and Risk Analysis: Beyond the Horizon, edited by R.D.J.M. Steenbergen, P.H.A.J.M. van Gelder, S. Miraglia, and A.C.W.M. Vrouwenverder, 1573–1578. London: Taylor & Francis. ISBN 978-1-138-00123-7.

41. Rodrigues, M.A., P. Arezes, and C.P. Leão. 2014b. “Risk Acceptance in the Furniture Sector: Analysis of Acceptance Level and Relevant Influence Factors.” Human and Ecological Risk Assessment: An International Journal. doi:10.1080/10807039.2014.957949.

42. Roeser, S. 2006. "The Role of Emotions in Judging the Moral Acceptability of Risks." Safety Science 44 (8): 689–700.

43. Rollenhagen, C., J. Westerlundb, and K. Näswallc. 2013. "Professional Subcultures in Nuclear Power Plants." Safety Science 59: 78–85.

44. Rundmo, T. 2000. "Safety Climate, Attitudes and Risk Perception in Norsk Hydro." Safety Science 34 (1–3): 47–59.

45. Siegrist, M. 1999. "A Causal Model Explaining the Perception and Acceptance of Gene Technology." Journal of Applied Social Psychology 29: 2093–2106.

46. Siegrist, M. 2000. "The Influence of Trust and Perceptions of Risks and Benefits on the Acceptance of Gene Technology." Risk Analysis 20 (2): 195–203.

47. Siegrist, M., G. Cvetkovich, and C. Roth. 2000. "Salient Value Similarity, Social Trust, and Risk/Benefit Perception." Risk Analysis 20 (3): 353–362.

48. Siegrist, M., H. Gutscher, and T.C. Earle. 2005. "Perception of Risk: The Influence of General Trust, and General Confidence." Journal of Risk Research 8 (2): 145–156.

49. Slovic, P. 1987. "Perception of Risk." Science 236: 280–285.

50. Tharaldsen, J.E., K.J. Mearns, and K. Knudsen. 2010. "Perspectives on Safety: The Impact of Group Membership, Work Factors and Trust on Safety Performance in UK and Norwegian Drilling Company Employees." Safety Science 48 (8): 1062–1072.

51. Tharaldsen, J.E., E. Olsen, and T. Rundmo. 2008. "A Longitudinal Study of Safety Climate on the Norwegian Continental Shelf." Safety Science 46 (3): 427–439.

52. Tholén, S.L., A. Pousette, and Törner, M. 2013. "Causal Relations Between Psychosocial Conditions, Safety Climate and Safety Behaviour – a Multi-level Investigation." Safety Science 55: 62–69

53. Tingley, D., J. Ásmundsson, E. Borodzicz, A. Conides, B. Drakeford, I.R. Ejvarjsson, D. Holm, K. Kapiris, S. Kuikka, and B. Mortensen. 2010. "Risk Identification and Perception in the Fisheries Sector: Comparisons Between the Faroes, Greece, Iceland and UK." Marine Policy 34 (6): 1249–1260.

54. Varonen, U., and M. Mattila. 2000. "The Safety Climate and Its Relationship to Safety Practices, Safety of Work Environment and Occupational Accidents in Eight Wood-Processing Companies." Accident Analysis Prevention 32 (6): 761–769.

55. Vinodkumar, M.N., and M. Bhasi. 2009. "Safety Climate Factors and Its Relationship with Accidents and Personal Attributes in the Chemical Industry." Safety Science 47 (5): 659–667.

56. Zohar, D. 1980. "Safety Climate in Industrial Organizations: Theoretical and Applied Implications." Journal of Applied Psychology 65 (1): 96–102.

57. Zohar, D. 2008. "Safety Climate and Beyond: A Multi-level Multi-climate Framework." Safety Science 46 (3): 376–387.